TRAINING MASTER COMPOSTERS AND ANALYZNG A MODEL OF BICYCLE-BASED FOOD SCRAP COLLECTION IN CENTRAL TEXAS

HONORS THESIS

Presented to the Honors Committee of
Texas State University-San Marcos
in Partial Fulfillment
of the Requirements

for Graduation in the Honors College

by

Josiah Michael Reese

San Marcos, Texas
December 2014

TRAINING MASTER COMPOSTERS AND ANALYZING A MODEL OF BICYCLE-BASED FOOD SCRAP COLLECTION IN CENTRAL TEXAS

Thesis Supervisor:

_____

Tina Cade, Ph.D.
Department of Agriculture

Second Reader:

_____

Mark Carter, M.A.G.
Department of Geography

Approved:

_____

Heather C. Galloway, Ph.D.
Dean, Honors College

Training Master Composters and Analyzing a Model of Bicycle-based Food Scrap Collection in Central Texas

Josiah Reese
Department of Geography, Texas State University, San Marcos, Texas

Abstract: The practice of depositing compostable materials into landfills is contributing to unnecessary greenhouse gas emissions and wasteful land use (Brown, 2013; U.S. EPA, 2012). Composting residential organic wastes such as food scraps, food soiled paper and dead leaves offers a simple solution to the degradation of local watersheds and soil (U.S. Compost Council, 2008). Local education, participation, and the cost of transporting collected organic waste are significant factors that limit the sustainability of resource recovery and processing (Shayka et al., 2014; Rai, 2011; World Bank, 2014a). Awareness and education of composting can increase participation and demand for organic waste collection and is a growing trend in both developed and developing countries (World Bank, 2012). Community leaders who are certified as local composting resources may be able to inspire and enhance grassroots composting efforts by promoting a comprehensive understanding and stewardship of soil, water, and waste management within communities. In an effort to reduce the harmful impact of fossil-fuel transportation, bicycles are increasingly used for low budget transportation methods in small-scale compost collection programs (Clark, 2014). Based upon criteria set by the State of Texas Association of Recycling and in conjunction with the City of San Marcos and Texas State University, this paper investigates the structure of a twenty-hour Master Composter Certification Course and analyzes the model of the bicycle-based organic food-scrap collection business, Compost Pedallers, in Austin, Texas to provide insight into effective community-based composting programs.

Introduction

The natural cycle of soil has become disordered and expensive through anthropogenic displacement of organic materials into landfills and poor soil management. By the year 2025, more than 2.2 billion tons of solid waste is estimated to be generated worldwide at an annual cost of over $375 billion (World Bank, 2012). The amount of compostable material in municipal waste streams is staggering (U.S. EPA, 2012) and sustainable methods for reducing organic waste are an urgent need (World Bank, 2012). The availability of cheap food, particularly in industrialized nations, encourages overbuying and irresponsible consumer behaviors that result in food waste (Harrison et al., 1975). Reducing food waste increases the availability of nutrients to individuals, improving community health (American Dietetic Association, 2001) and community food security (Hamm and Bellows, 2003). Composting is a sustainable reply to reducing food waste that originates in the production, distribution and consumption of food. Composting is an increasingly irresistible product with a growing market for its ability to protect watersheds, reduce pollutants and pathogens, effectively utilize invasive species, create jobs, and improve soil quality (U.S. Compost Council, 1996; ILSR, 2014; EPA, 2014; Glenn and Goldstein, 1999; Sembera 2013; Meier, Waliczek, and Abbott, 2014; Montoya, Waliczek, and Abbott, 2013).

Large-scale centralized compost facilities are often necessary to process the massive amounts of regional industrial and commercial organic waste, but transportation costs and regulations can restrict these operations from efficiently incorporating residential and small-scale organic waste markets (U.S. EPA, 2013; Platt, McSweeney, and Davis, 2014). Even though fixed-scale approaches to issues like organic waste

management may have the advantage of economic scale, they may not be able to respond quickly to changes in individual market behavior. The best approach may be the one which allows for a diverse and integrated collaboration of strategies accommodating present and future growth (McLeod et al, 1997). Furthermore, in *An Analysis of a Community Food Waste Stream*, Griffin, Sobal and Lyson (2009) suggest that "local efforts to decrease food waste that are unique to each community's food waste stream may be more effective in reducing total waste than nonspecific large-scale efforts."

In response to a growing environmental concern in the United States, small and medium-scale decentralized urban composting programs are fueled by a growing demand for quick, simple, and responsible waste management solutions (Belasco, 1993; Platt, McSweeney, and Davis, 2014). Grass roots composting initiatives are effective in increasing participation and demand for organic waste markets while supplementing the transition to larger-scale centralized organic waste operations that may be more efficient in the future. In the meantime, small-scale decentralized composting operations are favorable for their direct impact on harmful emissions and reliance on fossil fuels by decreasing the transportation weight from local waste streams to landfills. By improving local soil food webs and increasing environmental stewardship through community involvement, small-scale composting programs are an attractive solution to a growing amount of waste (Platt, McSweeney, and Davis, 2014).

Decentralized operations range from unorganized volunteer based pedestrian food scrap collection to profit-driven motor vehicle transportation with scheduled collection routes. The similarities in emerging organic waste programs generally include non-profit or low and slow-growth budgets that utilize a myriad of unique tools and techniques to

meet particular geographic constraints (Cotton, 2014). One of the unique transportation tools is the bicycle. Requiring less space on the street for maneuvering and parking, and generally not requiring licensing or fuel, bicycle-based food scrap collection and transportation is an expanding collection and transportation strategy permitted by some cities to be legitimate waste haulers (Cotton, 2014). Although bicycle transportation offers a low cost, highly efficient and simple solution, there is a lack of functional business and transportation strategies for bicycle-based compost operations to model after, especially in Central Texas.

Purpose

The purpose of this paper is two-fold. The first section investigates the structure of a twenty-hour Master Composter certification course. The Master Composter concept, and history, structure and implementation of a STAR Master Composter course held in San Marcos, TX is explained, quantified and reviewed. The second section of this paper discusses bicycle-based food scrap collection and evaluates the model of Compost Pedallers™, a small-scale decentralized food-scrap collection company in Austin, TX. By attempting to analyze the framework of successful compost training and food scrap collection in Central Texas, this paper aims to provide examples of potentially successful composting efforts in order to inspire others.

Methods

The author completed The State of Texas Alliance for Recycling Master Composter Train the Trainer Certification course on February 28, 2014 and implemented the Fall of 2014 Master Composter Certification Course for the City of San Marcos, Texas through partnership with Neil J. Kaufman from Texas State University Wildlife

Biology Department and Bobcat Blend Composting, Amy Kirwin, the Solid Waste Manager for the City of San Marcos, and the State of Texas Alliance for Recycling.

A ten question survey of course participants was conducted using the online platform Surveymonkey.com. Ten Master Composter course students rated their overall impression of the course, course structure, course material, course instruction, presentation style, and the likelihood of increased community participation on a Likert scale modeled from the Center for Teaching and Learning at University of Pennsylvania with considerations from other resources (Davidson, 2011; Lee and Paek, 2014). Students also provided demographic information and suggestions for course improvements.

Data for the Compost Pedallers was collected through the company's website https://compostpedallers.com/, email conversations and a phone interview with the Compost Pedallers Director of Membership, Christina Brandt, on August 27, 2014. The Compost Pedallers model was compared with two other bicycle based food scrap collection businesses in the United States through reviewing Nate Clark's article "Entrepreneurs see opportunity in food scrap collection" in the March 2014 issue of *Biocycle*. The author also shadowed a three hour Compost Pedaller food scrap collection shift by biking alongside an experienced Compost Pedaller employee on September 12, 2014.

STAR Master Composter Certification Course

Literature Review

Advanced and integrated composting courses available for community audiences in Texas are not well documented. It is without a doubt that awareness and education greatly affect public understanding and participation in recycling but more research is

needed to evaluate different strategies for the recycling of food scraps through composting (Thomas, 2001). Local libraries, gardens, and plant nurseries that offer gardening and farming classes often incorporate composting techniques but are generally limited to one session that does not adequately train participants on how to make and manage quality compost (Neave, 2011; Thomas, 2001). The Texas Master Gardener and Master Naturalist certification courses monitored by the Texas A&M Agrilife extension office are effective in training and empowering participants with the knowledge that can be used to encourage environmental stewardship within communities (Bonneau, 2003). It might follow that a Master Composter certification course would contain and require a comparable quality training to that of the forerunner Master courses and be an effective way to educate individuals. Certifications play a major role in affirming credibility within North American society (Cantor, 2002) and the benefits of backyard composting are obvious, thus far public knowledge of backyard composting theory is relatively nonexistent within most urban communities, much less, appropriate land management (Downing, Kays, and Finley, 2009). The need to increase quality compost education and participation in sustainable waste management is apparent in almost every community (Goldstein, 2001a; Waste Concern, 2010).

The good news is that the effectiveness and performance of recycling and composting programs are not dependent on the social characteristics of a community. On the contrary, Folz and Hazlett (1991) found that cities with the highest recycling rates depend almost completely on the quality of the design and implementation of the program by managers and community leaders and Folz (1999) heralds the importance of collaboration between community organizations. Regardless of community

demographics and social characteristics, effectiveness of compost education courses and increases in community participation relied upon the quality of the course. Successful programs tended to set specific recycling/composting course goals through utilizing and marketing community-based public education strategies and establishing a composting program (Folz and Hazlett, 1991). Basically, enhanced public recycling and composting education courses should be well designed and coproduced between citizens and local governments to effectively train and motivate students while fostering environmental organizations and established compost programs (Vining and Ebreo, 1989, 1990; Folz and Hazlett, 1991; Folz, 1999).

Wanting to follow in the footsteps of the Master Naturalist and Master Gardener programs, the Master Composter concept has been undergoing convergent evolution across the United States and is a rapidly growing idea spreading across broad geographic regions. Searching "Master Composter" on Google reveals that Master Composter courses are currently offered in more than fifty cities and counties in the United States ranging from California to Washington and Georgia to New York. However, there is no one set standard for a Master Composter Certification Course (hereafter referred to as MC). Universities, local governments or institutes of higher-learning are prevalent attributes to most of the current and former MC courses. Borrowing from an earlier Texas compost training curriculum, the 1998 the Cornell Waste Management Institute publication titled "Master Composter Manual" provides a "Master Composter Implementation Guide" and "Master Composter Resource Manual" which in turn supplements New York City's Compost Project "Master Composter Manual" (Cornell Waste Management Institute 1998). The New York City Compost Project (NYC CP) was

created in 1993 by the NYC Department of Sanitation's Bureau of Waste Prevention. The NYC CP claims that in 2013 290 MC events reached 6,502 New Yorkers with 2,000 volunteers working at community-based compost sites (NYC Department of Sanitation, 2014). The NYC CP employs outreach, education, food scrap recovery, technical support, compost distribution and a network of urban farms on a community-based level to achieve the quality of an open and democratic program advocated by Folz and Hazlett.

The local perception of what a well-designed and implemented educational compost course should look like is diversely defined by various communities across the country. The differing measures of quality and heterogeneity of MC programs throughout the U.S. is, however, not necessarily a disadvantage. The open-ended definition of quality in design and implementation allows for diverse strategies that are more likely to integrate with locally independent and decentralized composting movements and methods that can enhance the credibility in specific communities (McLeod et al., 1997; Vining and Ebreo, 1989).

The culture of environmental awareness and rate of urbanization are on the rise. Therefore, interest in home and backyard composting can be projected to follow suit with other green initiatives. What can be taken from the limited review of literature and lack of documented analysis of completed and current Master Composter certification courses is that communities might first regard the adage of GIGO (garbage in, garbage out) as an appropriate control when developing educational compost programs. Moreover, educational programs and increased accessibility to recycling opportunities significantly affect the relationship between people's attitudes toward solid waste management and their recycling motives (Ebreo and Vining, 2000). It appears then that the effectiveness of

an educational composting course depends on more than just the quality of the design, structure, and implementation of the curriculum, but also on the quality of the support network for composting and recycling in the local area.

History

Americans are increasingly participating in recycling because it is a practice that can be done on an individual basis. Even so, Americans do not recycle enough (Bell et al, 2014; Markle 2014). The State of Texas Alliance for Recycling (STAR) is a 501c3 recycling organization whose mission is to increase recycling rates in Texas. STAR aims to be the resource for all things recycling in Texas. Recognizing that recycling is the lowest cost, easiest, most readily available way to conserve natural resources for a strong economy and healthy environment, STAR is helping to initiate The Texas Recycling Data Initiative (TRDI) which is the first-ever statewide effort to quantify how much recycling is actually occurring in Texas annually.

STAR is a diverse system of members with the board of directors including members from the City of Denton, City of San Antonio, Risa Weinberger and Associates, Inc., CompuCycle, CPS Energy, The Woodlands Township, Waste Management, RMA Consultants, LLC, Houston-Galveston Area Council, Balcones Resources, and the City of Houston. Partners of STAR include Electronic Resource Recovery Council, Central Texas Recycling Committee, Gulf Coast Recycling Council, Greater DFW Recycling Alliance, Texas Compost Council, and Texas Product Stewardship Council. STAR is sponsored by BAE systems, Earth Day Texas, Austin Resource Recovery, CPS Energy, City of Denton Solid Waste and Recycling, and The Woodlands Green. Essentially, the membership of STAR is composed of 54% Governments, 34% Businesses and 12%

Nonprofits to accomplish the mission "to increase recycling rates to the highest level afforded by balanced economic and sustainability principles, for the benefit of Texas" (STAR, 2014).

In 2007, the U.S. Environmental Protection Agency funded the Yardwise program created by the Texas Commission on Environmental Quality (TCEQ) and the Lady Bird Johnson Wildflower Center for environmentally responsible yard care and integrated pest management. The Yardwise program and web-site was reviewed and re-launched by STAR in affiliation with the Texas Compost Council (TCC). Objectives of the Yardwise platform include reducing urban runoff and improving water quality in six major urban areas of Texas: the Dallas/Fort Worth Metroplex, Austin, San Antonio, Houston, Corpus Christi, and the Lower Rio Grande Valley. The benefits of Yardwise and STAR are numerous and include the online game called the *YardWisdom Quest* (https://yardwise.recyclingstar.org/game/) and a regional inventory for backyard and landscaping resources. Additionally, in early 2014, STAR launched the Master Composter program that made possible the City of San Marcos 2014 Master Composter Certification Course.

Background

Master Composter trainings consist of twenty hours of education and training, followed by twenty hours of volunteer service empowering students to take action throughout the community to share with as many Texans as possible the benefits of composting. STAR also serves as the statewide administrator for the MC program providing the curriculum, technical assistance, and networking for communities that host Master Composter trainings. Training orientations for both local community coordinators

and potential Master Composter course instructors are also administered through the alliance. Along with managing a database of local trainers, instructors and coordinators STAR, works with coordinators to review and approve completed Master Composter applications. Official certificates are provided to coordinators who help manage the database of Certified Master Composters. In total, STAR serves as a resource for local coordinators and instructors by providing curriculum and program consultation and advice (STAR, 2014).

Local coordinators are often gleaned from being affiliated with municipalities, governments, nonprofit or from programs like Keep Texas Beautiful. Coordination of the MC course includes providing training materials, training locations, demonstration sites, volunteer opportunities and advertisement of the MC course within the community. The monitoring and managing of the MC training, volunteer hours, application process, and issuance of certificates are largely the responsibilities of the coordinator.

Qualified Master Composter trainers/instructors must complete the MC instructor course, or work with a coordinator who has completed a MC orientation. Instructors work with the local coordinator to create the course agenda based upon the course structure. Instructors create presentations, lectures and demonstrations. Instructing twenty hours of coursework (fifteen hours of lecture and five hours of hands-on compost experience), providing technical information, and assisting the coordinator and administrator are the understood responsibilities of MC Instructors (STAR, 2014).

There is not a recommended standard for the number of instructors per course but the maximum number of students per course to be twenty, with certain exceptions (STAR, 2014). Administrators, Coordinators and Instructors work together to produce the

twenty-hour MC certification course that best fits the target community. The coursework can be divided and scheduled depending on the availability of instructors and training venues, community constraints such as local events and schedules, and other limiting factors recognized by instructors, coordinators and STAR.

Implementing a Master Composter Certification Course in San Marcos

Under the administrative management of Sara Nichols, the Program Director for STAR (STAR, 2014) and coordination of The City of San Marcos' Department of Solid Waste Manager, Amy Kirwin, the San Marcos Master Composter Certification Course was conducted from October 13, 2014 to October 25, 2014. Through a 2014 Keep Texas Beautiful initiative, the coordinator, Amy Kirwin, attended a STAR MC Coordinator orientation as an affiliate of the Keep San Marcos Beautiful program. Fulfilling the responsibilities of the local coordinator Kirwin secured snacks, supplemental materials and supervised the marketing and advertising of the course through social media, a local press release [Appendix A] and a television interview of the MC instructors by Time Warner Cable News of Austin, TX showcasing the MC course.

The Instructors for the course originated from Bobcat Blend Composting, an award winning student-run compost organization from Texas State University's Department of Agriculture, funded in part by the Texas State University Environmental Service Fee. Neil Kaufman, a Wildlife Biology major, and the author completed STAR's Train-the-Trainer course for instructing Master Composter Certification Courses on February 28, 2014. The instructors were notified in August 2014 of the potential to instruct a MC course in San Marcos during the fall semester and began construction of a

tentative agenda in mid-September after the training location, class schedule and course materials were confirmed by the coordinator and administrator.

Training Location

The training for the MC course was held at the San Marcos Nature Center (SMNC) [Appendix B-1], centrally located at 430 Riverside Drive, San Marcos, TX 78666. The SMNC serves as an educational outreach of the City of San Marcos to forward the city's commitment to the Edwards Aquifer Habitat Conservation Plan. By informing and educating the public about the San Marcos River Watershed ecosystem, it hopes to increase conservation and restoration of the watershed and its indigenous wildlife. The SMNC hosts a variety of indoor and outdoor animal exhibits as well as a wildscape garden of native plants from the San Marcos area. The SMNC was an ideal venue for the MC course and allowing the MC course access after hours of operation provided for privacy and comfort within the space.

Agenda

The course schedule was designed to be a two week program that would accommodate an audience after business hours, during evenings and weekends. The official schedule incorporated two Monday and Wednesday evenings from 6:00pm to 8:30pm and two Saturday mornings and afternoons from 9:00am to 2:00pm [Fig. 1]. The first course day, Monday, included an introduction to the MC course, STAR, the instructors, coordinator and students, overview of the STAR MC Certification course, course agenda, and course expectations. Wednesday's class was a two and a half hour interactive lecture on composting fundamentals that included relevant issues, history and basic composting science. Saturday included five hours of lecture on soil and compost

science with a short break for lunch. The second Monday encompassed two and a half hours of lecture on advanced and alternative composting techniques, a vermiculture workshop, and compost troubleshooting. The last Wednesday featured a two and a half hour discussion of Yardwise landscaping, compost application, water conservation, and answering participant questions. On Saturday, for the last class session, the participants car-pooled to the Bobcat Blend compost facility and participated in a small-scale food waste processing workshop from 9:00 a.m. to 1:00 p.m. which included monitoring and testing fresh, working and mature compost piles, screening cured material, brewing compost tea, and assembling three backyard compost containment systems. At 1:00 p.m. the class car-pooled to a community garden in San Marcos called the Dunbar Community Garden. One of the students was the composting supervisor for the garden and allowed the class to evaluate and offer suggestions for managing the compost piles until 1:45 p.m. after which the instructor held a question and answer session and concluded the course.

Fall 2014 San Marcos Master Composter Schedule and Agenda			
Day	Monday 6:00-8:30pm	Wednesday 6:00-8:30pm	Saturday 9:00-2:00pm
Week 1 10/13	Introduction, course outline, objectives	History and fundamentals	Science of composting
Week 2 10/20	Composting techniques, alternative techniques, troubleshooting	Yardwise landscaping, compost application, water conservation	Field Day: Bobcat Blend workshop, Dunbar Community Garden

[Fig. 1 – MC Schedule and Agenda]

Curriculum and Materials

STAR provided twenty copies of required texts that included the Yardwise publication A *Green Guide to Yard Care*, *The Rodale Book of Composting* and *Home Composting Made Easy*, at $20 per participant. The City of San Marcos covered the initial investment cost of the books and did not charge participants any additional fees. Additional materials for the course such as visual aids can be considered optional but are recommended for efficient concept transmission (Cornell, 1998). Materials for lectures included a projector and screen provided by the SMNC, the instructor's personal laptops and speakers, a stackable worm composting bin, a 100x microscope, twelve boxes (30ct.) of 2.5 gallon compostable bags, a 12oz. bag of humus, 20ft of wire, three wooden pallets (4'X4'), three metal wire shelves (3'X4') and a plastic Soil Saver® backyard compost bin. Supplemental equipment used on the last class day included Bobcat Blend's work truck (2007 GMC 2500), Caterpillar Loader, Compost Screener and 1,600 gallon compost tea brewer with ingredients [Appendix B-2].

Class Structure

The instructors based their MC lecture profiles on previous compost education experience with Bobcat Blend and Texas Disposal Systems and the STAR MC Train-the-Trainer course. Lecture topics required by STAR included basic composting science, techniques and application, water conservation, and Yardwise practices including landscape planning, wildscaping, xeriscaping, grasscycling, and integrated pest management. The presentation structure and style of lectures are not standardized by STAR and are open to the reasonable preference and interpretation methods of the instructor. There are many educational theories that offer valid methods for transforming

informal science settings into legitimate science education (Rahm, 2014) but it seems crucial throughout that educators should supplement quality instruction with appropriate technology to produce an excellent educational experience (Weissblueth, Nissim, and Amar, 2014).

The instructors employed Prezi.com™, a web based presentation software that utilizes cloud technology to allow for near unlimited accessibility and advanced interactive presentation techniques (Prezi, 2014). Prezi uses a zooming dimension that opens another dimension for storytelling and presenting but requires practice to communicate ideas effectively (Perron and Stearns, 2010) and cannot be used as simply as a PowerPoint (Rockinson-Szapkiw, Knight, and Tucker, 2011). In order to minimize distraction and avoid over-whelming the audience with an inconsistent presentation style a simple Prezi template called "organic" was used [Appendix B-3].

Prezi.com supplied stimulating visual aid to supplement the lecture and is not meant to be stand-alone teaching devices for the MC course. Lectures were not recorded or pre-rehearsed and were delivered in a coherent impromptu fashion in rhythm with the Prezi.com presentation. The individual Prezi.com presentations are available to the public and can be found by searching Prezi.com for "S.T.A.R. Master Composter" or by following the provided hyperlinks:

Day 1: http://prezi.com/g5r7vdoid8fi/star-yardwise-master-composter/

Day 2: http://prezi.com/cbmf_bj0lgsi/composting-basics/

Day 3: http://prezi.com/ak9xgwvmpqz4/star-yardwise-master-composter-day-3/

Day 4: http://prezi.com/yntegvnugxx2/star-yardwise-master-composter-day-4/

Day 5: https://prezi.com/r7bvlhidq5jm/star-yardwise-master-composter-day-5/

The final day of the MC course entailed all ten participants visiting Bobcat Blend's Composting Facility and the San Marcos Dunbar Community Garden. Following the recommendation for a portion of the course to be hands-on composting experience, a workshop was designed by the instructors to involve course participants in the function of Bobcat Blend's processing, turning, testing, curing and screening of compost and brewing of compost tea [Appendix B-4,5,6,7,8,and 9]. Participants also helped assemble three different backyard compost containment structures [Appendix B-10] to showcase the difference in backyard containers and bins (Karnchanawong and Suriyanon, 2011). Healthy snacks were provided by the coordinator before the group visited the San Marcos Dunbar Community Garden to examine and analyze the garden's compost operation and participate in a question and answer session before concluding the course.

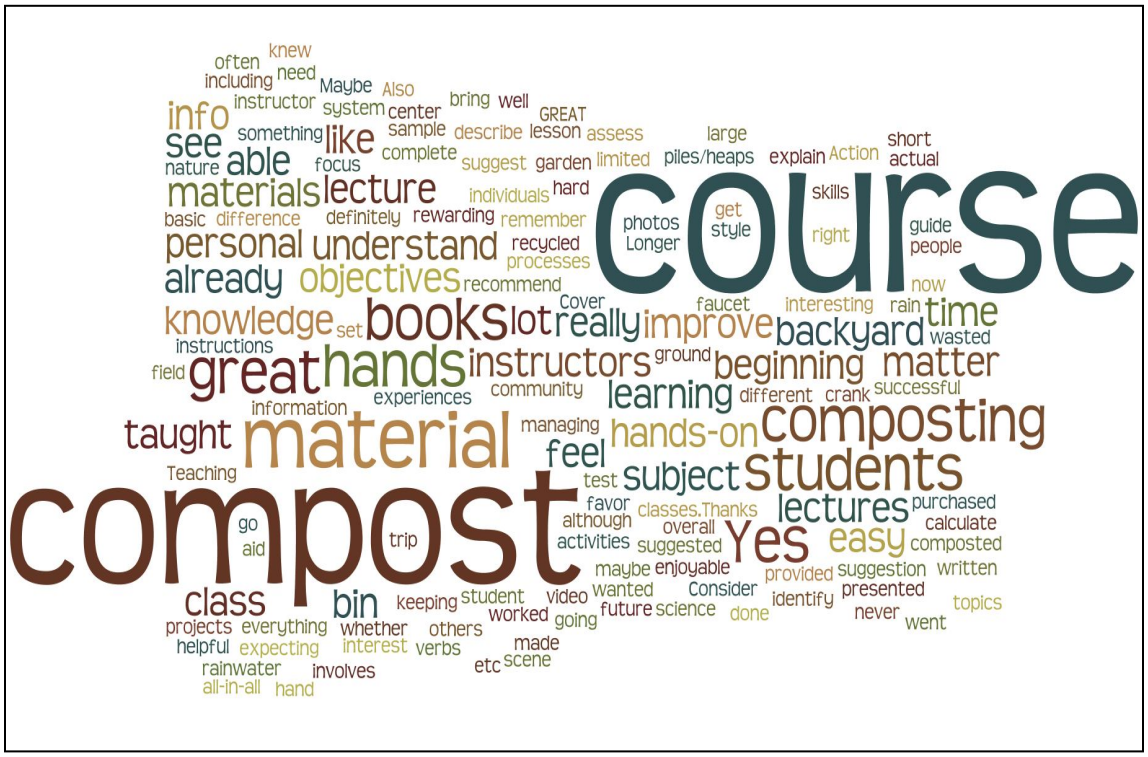
Course Survey

In order to investigate the structural effectiveness of the course, a ten-question online survey was sent to the ten participants to rate the course anonymously after the last day of instruction. Participants were asked to rate the course over-all, the course structure, the course material, the course instruction, the Prezi presentation style, and the likelihood of increasing their community participation. Demographic information was collected including gender, ethnicity, and age. Questions were rate on a Likert scale with 1 representing "Strongly disagree", 2 "Disagree", 3 "Neither disagree nor agree", 4 "Agree", and 5 being "Strongly agree". Six fields were available for additional comments.

Survey Results

Of the ten participants, nine successfully completed the online survey through Surveymonkey.com. For the question "How would you rate the Master Composter Course overall?" the majority of respondents strongly agreed that "The course was a quality learning experience" (77 %), "The course was a good value for the price and time" (77%), and "Your ability, confidence and desire to compost was significantly enhanced because of this course" (55%) [Appendix C-1]. The course structure was evaluated with 88% of participants agreeing that the class days and time were convenient and 77% strongly agreeing that "The class location was convenient" [Appendix C-2]. In total, 100% of respondents agreed that "the lectures provided valuable information…were easy to understand" and that "the textbooks were helpful" [Appendix C-3]. The course instruction was valued with 77 % of respondents strongly agreeing and 22.22% agreeing that "the instructors were engaging, helpful and knowledgeable" [Appendix C-4]. The Prezi.com presentation style was rated with the 55% agreeing with the statement "Prezi was more effective than a traditional power point presentation" and 44% neither agreeing nor disagreeing [Appendix C-5]. Overall, 75% of respondents noted that they were very likely to increase their community involvement because of this course [Appendix C-6]. Demographic responses showed that 55% of participants were female, 66% of participants identified as white/Caucasian, and the ages of the participants were 33% 18 to 24, 33% 25 to 34 (33%), 11% 35 to 40, 11% 45 to 54, and 11% 75 or older[Appendix C-7,8,9]. Seventeen suggestions were offered; seven of those responses were to the last question on the test "Do you have any suggestions for improving the Master Composter Course?" [Appendix C-10]. The most frequent suggestions called for

more “hands on” composting experiences and to offer a short official break during the two and a half hours lecture [Appendices C-11]. One comment also suggested that a short field trip should be conducted at the beginning of the course and to clearly identify learning objectives before each lecture in order to offer an enhanced measure of course effectiveness [Appendix C-12]. Wordle™ was used to create a word cloud from the most used words from the comments and suggestions provided by respondents [Fig. 2]. The size of the word correlates the number of times it was used by respondents.



[Figure 2 – Wordle™ Word Cloud]

Discussion

Was this Master Composter course effective in increasing compost education and participation in San Marcos? Only time will tell, but the survey responses

can be interpreted as to confirm that the structure of the 2014 City of San Marcos STAR MC course provided for a quality education experience that empowered further participation in local composting efforts. As this is the first STAR MC course held in San Marcos, and given that the course participants have not yet completed their volunteer requirements, the course cannot be evaluated as successful. A follow-up survey and interview with the course participants after they complete their volunteer requirements may offer valuable insight for how to better accommodate participatory and volunteer opportunities within the community. In the interim, a more in-depth analysis of the material, instruction, lecture and experiential components of this course as well as any concurrent Master Composter courses in Texas will better prepare STAR, instructors and coordinators for future MC courses in San Marcos. A language barrier was present during the course with a participant who was hearing-impaired. The issue was recognized and resolved by cooperating with the student's lip-reading skills throughout the course. Language, electricity supply and technical difficulties or malfunctions are barriers to the effectiveness of lectures and should be managed for appropriately in MC courses.

The city of Austin's *2011 Resource Recovery Master Plan* called for the initiation of composting trainings at community gardens and implementing Junior and Master Composter training programs (City of Austin, 2011). Research also suggests the need for coordinated statewide efforts to involve compost end users and knowledgeable compost producers that successfully market and utilize their product. Through integrating the resources of Texas State University Bobcat Blend, the City of San Marcos Solid Waste Department, and STAR, this Master Composter course highlights the idea that integration, notably with universities (Audi, Keating, Sterling, and Weber, 2014) can be

an invaluable approach to the production of an effective compost training program. Through open communication, community networking and instructor collaboration, the first San Marcos MC course might be used as a guide for future MC courses directed towards communities and businesses.

Bicycle-based Food Scrap Collection

Without an established North American Industry Classification System (NAICS) code, the composting industry faces an obstacle in quantifying the economic value of compost (Alexander, 2009). The end use of compost as related to quantifiable environmental benefits in agriculture is the most cited valuation of compost since farms constitute a large portion of the compost market (Alexander, 2009; Kashmanian, 1995). The end use of compost is increasing (Kashmanian and Rynk, 1996) and its value is also quantified through environmental benefits such as the diversion of food scraps from landfills, principally, decreasing emissions from the transportation of food scraps and emissions from food scrap decomposition (EPA, 2012).

A 2014 World Bank brief on low-emission transportation notes that the transportation sector is the fastest growing consumer of fossil fuels and the fastest growing source of CO2 emissions. Additionally, the long-term mobility patterns and future level of greenhouse gas emissions are determined by today's transport investment choices.

Community compost education and participation has increased the interest in food scraps diversion business opportunities, particularly collection services (Clark, 2014). The strategies for collecting and transporting food scraps and the innovation of integrating the processing of compost or delivering of food scraps to third party compost

facilities qualifies food scrap collection as a remarkable entrepreneurial concept (Carland, Carland, Hoy and Boulton, 1984).

Research, markets, and examples of decentralized networks for bicycle transportation are quickly mounting (Fekpe, 2002; Handy, Wee, and Kroesen, 2014; Gruber, Kihm, and Lenz, 2014; Hyodo, Suzuki, and Takahashi, 2000; Krenn, Oja, and Titze, 2014). An example of successful bicycle transport is outlined in a 2013 article from Oregon Public Broadcasting. B-line™, a Portland-based delivery company that uses electric-assist bikes to haul 700 pounds per load and, depending on route specifics, provides a service equal to truck deliveries for a competitive price (Profita, 2013). In addition, 70,000 pounds of perishable food have been saved from becoming waste by the company's ability to quickly transport rejected produce from grocers to homeless shelters more efficiently than trucks (Profita, 2013).

Bicycle-based food scrap collection is an increasingly popular entrepreneurial pursuit that is somewhat limited by obvious environmental factors such as weather, elevation and traffic and less obvious factors such as policy and regulation. The practicality and efficiency of bicycle transportation is nonetheless a solution to the growing demand for sustainable transport (Tripathi, 2013). Bicycles have been used for transportation since 1817 and still account for large amounts of freight transportation across the globe (Petty 2001). Drawbacks to bicycle use involve safety concerns such as instability (Van Vliet, 2014) and vulnerability (Schlossberg, Evers, Kato, and Brehm, 2012). The tradeoffs of environmental vulnerability and physical instability for low investment, maintenance and operation costs can brand bicycle transportation as an attractive tool for small-scale food scrap collection.

Examples of Food Scrap Collection

Nate Clark's article "Entrepreneurs See Opportunity in Food Scraps Collection" in the April 2014 edition of *Biocycle*, provides insight into food scrap collection by interviewing four innovative small-scale residential and commercial food scrap collection services from Michigan, Louisiana, Florida and South Carolina. Two of the operations, Carters Compost and Gainesville Compost, rely on bicycles for the collection and transportation food waste and offer models of comparison for other small-scale food scrap collectors.

Carter's Compost is a privately-owned bike-powered food scrap collector and compost processor in Traverse City, MI which is a city of approximately 15,000 residents. Ty Schmidt and his nine year old son, Carter, use bicycles with trailers and describe their mission as being dedicated to building community through educating and making it easy for neighbors to compost on their own. As of 2013, Carter's Compost employs six workers to collect about 60 5-gallon buckets of food scraps per week from about one hundred residential customers and fifteen businesses that are charged $10.00 per month for the service. Their fee is not necessarily valued in terms of a quantified environmental benefit or complex business model; rather, the fee is based on the company's valuation of their provided service. In addition to collecting food scraps, Carter's Compost partners with neighbors to process the food waste into compost at eighteen separate backyard composting piles. Recognizing that space for composting is their greatest limiting factor, Carter's Compost claims that community compost education is their main objective in reaching their goal of increasing backyard composting.

Gainesville Compost (or The Bike Composters, LLC) of Gainesville, FL with a population of 160,000, started collecting food scraps in 2011 and is also a privately-owned bike-powered business. Their mission is to build a pedal-powered community compost network in order to reduce waste and support food production in the city. Five employees collect and deliver about one ton of food scraps per week from eighteen restaurants and ten residences to a network of community composting sites they manage as backyard composting operations. Most of the bike crew routes are under a mile from restaurant to composting center and member businesses are advertised on bike trailers. Bike crew members are paid per collected container which creates an incentive for employees to increase customer participation in the region that they service which ideally increases collection route density and revenue potential for each route. Employees are also provided with sales commission for recruiting new customers, so each rider has an incentive to create denser routes while making the bike crew position an attractive job and enabling the company to swiftly collect from a smaller area while increasing profit.

Food Scrap Collection in Austin, TX

Food scraps and compostable paper account for about 30 percent of citywide disposal in Austin, TX, a city of just under 900,000 residents (U.S. Census, 2014) where decentralized composting infrastructure is considered one of the highest and best uses for residential food scraps (City of Austin, 2011). Sitting on an ecotone split from north to south by the Balcones escarpment, Austin presents a challenge of topographic relief to bicycle food scraps collection in addition to requiring waste collectors to acquire annual waste hauler permits within the city (City of Austin, 2011).

The Zero Waste Strategic Plan adopted by the Austin City Council has set solid waste goals calling for seventy-five percent of waste from landfills and incinerators being diverted by 2020 and ninety percent of diverted by 2040 (Gary, 2008). However, the Austin Master Plan aims to surpass those standards by diverting fifty percent by 2015, eighty-five percent by 2025, ninety percent by 2030, and a zero waste restorative economy by 2050 (City of Austin, 2011). Furthermore, The City of Austin's Master Plan anticipates that by the 2016 fiscal year, a Universal Recycling and Composting Ordinance (URCO) will require single-family residences to recycle and compost (City of Austin, 2011).

The gravity of Austin's plan for zero waste grasped the attention of a particularly unique composting effort within the city, one that hopes to ensure that Austin's plans accommodate decentralized small haulers like the Compost Pedallers (Brandt, 2014).

Compost Pedallers Background

After their first collection on December 5, 2012 the Compost Pedallers (aka East Side Compost Pedallers; hereafter referred to as CP, or Pedallers) won The Austin Chronicle's Best of Austin Award for best green program in 2012 and 2013. The CP is a completely bike-powered food scrap collection and composting company that pedals food scraps from homes and businesses directly to nearby urban farms and community gardens known as "comphosts". Valuing sustainability, community, simplicity, and creativity, the Pedallers mission is to build a more vibrant Austin community by reducing waste, strengthening local food systems, and re-connecting neighbors to each other and the places that they live through more sustainable practices, all without using fossil fuel.

Supplemented by investment from a co-founder, the CP utilized the crowd funding platform Kickstarter Inc. for most of the upfront costs of bikes and bins and can be considered a slow-growth or slow-money business. Initially run by two cofounders, one Pedaller, and an office worker, their original transportation fleet was comprised of two front hauling bicycles [Appendix D-1] made by a Portland-based company called Metrofiets, LLC. Like Carter's Compost, finding space for composting was an issue that the CP solves by actively networking to contract host sites for compost piles at community and backyard gardens. The Pedallers have since expanded and Christina Brandt, the Pedaller's Director of Membership explains that "we are now a team of seven full timers, ten part timers and an intern, and it seems to be growing by the day as we increase our membership and service area" (Brandt, 2014). As of October 2014, the Pedallers service about 400 residences, close to 25 commercial customers and have diverted 200,000lbs of organic waste, produced 50,000lbs of compost, saved local gardens $5,300 in compost purchases, and saved the equivalents of 13,500 gallons of diesel fuel and 31 tons of methane while having pedaled 1 million calories [Appendix D-2] (Compost Pedallers, 2014).

Compost Pedallers Business

The Pedallers strategy [Appendix D-3] involves identifying and establishing community districts and locating within each district a headquarters that serves as a transport hub for collection routes. The Austin neighborhoods that are served as of November 2014 include Cherrywood, Holly, Windsor Park, Mueller, Hyde Park, North Loop, and Skyview [Appendix D-4]. Ideally, composting sites sponsored by comphosts are also established in each district. For $17.32 per month ($4.00 per week, plus tax),

residential customers, who are referred to as members, are provided an air tight five gallon bucket with a compostable paper bag liner that is weighed, collected, cleaned and given a fresh liner once per week (Brandt, 2014). The paper bag liner also serves as a messaging system for Pedallers to leave comments, suggestions or notes of appreciation for members.

Members place their five gallon bucket outside their residence at a convenient location prior to their designated weekly collection time. Upon arrival at a member's location, a bike crew pedaller retrieves and weighs the bucket using a heavy-duty digital fishing scale [Appendix D-5]. The bucket's weight is immediately entered into a smart-phone application, the Apple iphone and ipad application, Numbers, which allows office personnel to access and utilize the data. The bucket's liner of organic contents is placed into a larger container depending on bicycle model. Using a biodegradable soap and water mixture the pedaller cleans the bucket and lid then replaces the paper bag liner after leaving written notes on it. The bucket is returned to its initial location outside.

A weight-based incentive program called "the loop" exchanges one pound of food scraps, termed by the Pedallers as "scrapple" [Appendix D-6], into one credit point. These points can be redeemed online through the Pedallers website to obtain a variety of products, merchandise, coupons and services from businesses in the local community. Partnerships between the CP and local businesses can be considered similar to the Gainesville Composters in that there exists mutual advertising and sponsored support. But a unique difference is that the Pedallers define the cyclical connectivity of a pound of food waste translating to economic value, exchanged for local goods from their partners as "the loop" [Appendix D-7]. The loop is embodied by partners providing gifts,

donations or incentives such as coupons for the point based incentives program managed by CP.

Loop incentives range from compost, a free week of yoga and local produce, to a cup of coffee, bike tune-ups and a Fairdale bicycle. For 10 points however, customers can gift one free month of CP service to a qualified friend.

The CP currently collects and delivers approximately two tons of food scraps per week to contracted comphost partners such as Kealing Middle School, Springdale Farms, Urban Patchwork, Ten Acre Organics, 5604 Manor, F-stop Farm, New Day Community Garden, Helping Hand Home for Children, Sunshine Community Garden, Food is Free Microfarm, Hyde Park Community Garden, Festival Beach Community Garden, Wendy Town Farms, St. David's Community Garden, Blackshear Neighborhood Garden and other community comphosts (Brandt, 2014). Comphosts are under contracts that ensure food scraps are processed into quality compost and depending on the agreement comphosts may allot a certain percentage of the final compost product for the Pedallers. Permits for compost piles are limited by the small size of backyard style piles, but in the future, permits may be required.

Bike crew employees are required to practice good customer service, perform proficient bicycling and navigation, move containers weighing up to one hundred pounds, and successfully complete two full training routes before being approved to work collection shifts alone. Knowledge of bicycle maintenance and composting are also useful skills for the job. All pedallers start at $10 per hour and are evaluated for up to a two dollar raise every six months. Additionally, all employees receive $17.32 as

commission for recruiting new members and are eligible for commission based incentives for recruiting new CompHosts.

Depending on route specifics, collection shifts generally start at 7:00 a.m. and end at 3:00 p.m. with a bike crew member servicing no more than about sixty homes per shift. Commercial food scraps are occasionally collected at the end of residential shifts but most commercial routes are conducted during two routes on Sundays. In an e-mail to the author on October 28, 2014 the CP Director of Membership, Christina Brandt, revealed that after their inclusion of a sales team member, numbers began increasing at an approximate rate of ten new members per week. With a quickly growing network, new district headquarters will be necessary to guarantee route efficiency.

Compost Pedallers Transportation

The CP transportation fleet currently utilizes three Metrofiets bicycles [Appendix D-1] and two custom welded pedi-cab style tricycles [Appendix D-8] and hopes to add a bicycle and trailer soon. The reason for a diverse fleet is to identify a model that best fits the Pedallers needs and which will transfer into a uniform fleet in the future (Brandt, 2014). While front loaded cargo bikes can be more unstable than rear cargo bikes, cargo that is behind the bicycle operator is unsupervised during transportation. The Metrofiets cargo bike carries cargo in front of the rider which with the geometry and durable materials allows for a highly maneuverable bike that can carry up to four hundred pounds of rider and cargo (Metrofiets, 2014). The CP utilizes the front cargo platform on the Metrofiets to support a fifty five gallon barrel, or similar container, to hold the collected food scraps during transportation. The tricycle models have slightly more weight capacity but the increased height of the cargo area from the ground proves to be a challenge when

loading and unloading heavy containers. Even though the Metrofiets models have a shorter distance from the cargo platform to the ground, moving a heavy container from the bike to a compost pile that cannot be closely accessed by bicycle remains an issue that the Pedallers are looking to solve.

Each bicycle is equipped with a basic tool kit for mechanical issues that might arise during a collection shift. Fixing flat tires and similar small issues can generally be solved with the tool kit. Bicycles with more serious issues are solved by a knowledgeable bike mechanic.

In addition to trialing different bicycle models for efficiency, the Pedallers currently incorporate a myriad of technological tools for managing efficient transportation. The mapping, navigation and optimization of routes play an important role in maximizing efficient food scrap collection and transportation. Using Route4Me.com and the Apple iPhone application Route Tracker by raah.co, the Pedallers are able to provide for route efficiency and safety through analyzing elements such as route distance, elevation [Appendix D-9], infrastructure, traffic, and connectivity (Brandt, 2014). The Pedallers distinguish efficiency as the primary goal in establishing routes as short distances that contain a high density of members, but the safety of employees is the greatest priority, especially at intersection crossings (Brandt, 2014). By estimating the amount of food scraps that is collected from a certain number of members, routes can be optimized to allow for drop-off points at comphost sites before the food scrap container reaches capacity. Reviewing routes for unsafe road conditions can help increase the safety of bike crew pedallers as well.

Discussion

It is plausible that if a cap and trade benefits program were to be enacted in the United States for carbon dioxide and green house gas emissions, then investment in composting efforts would significantly increase (Alexander, 2009). By continuing to analyze and investigate the strengths, weaknesses, opportunities, threats, markets, products, capabilities and competition, the Pedallers have the capability to continue to successfully grow into a long-lasting program that can help Austin's waste management goals (Al-Araki, 2013; Boulton, 2001; Meewes, 2014). In comparison to the 2013 review of Carter's Compost and Gainesville Compost, the Compost Pedallers are of a larger scale in terms of city size, membership, collected tonnage, employee base, and partnerships [Fig. 3].

	Carter's Compost	*Gainesville Compost*	*Compost Pedallers*
Hauling Process	Bike and trailer	Bike and Trailer	Front-load Bike, Rear-load Trike
Collection Frequency	Weekly: 5-gallon bucket	Weekly: 5-gallon bucket, 32-gallon container, 64-gallon	Weekly: 5-gallon bucket
Customer Base	100 residents, 15 businesses	22 generators	400 residents, 25 businesses
Price	$10.00/mo.	5-gallon: $16/mo.(+$10.00 sign up), 32 or 64-gallon	$4.00(+tax)/week, $17.32/mo.
Services	Food Scrap Collection: Residential and small-	Food Scrap Collection: Residential and commercial	Food Scrap Collection: Residential and business
Start Date	2012	2011	2012
Number of Employees	6	5	7 Full-time, 10 Part-time, 1 Intern
Region (2012 Pop.)	Traverse City, MI (14,908)	Gainesville, FL (126,636)	Austin, TX (864,407)

Source: U.S. Census Bureau. State and Community Quickfacts. Population, 2012 estimate (http://quickfacts.census.gov/qfd/index.html), Clark, N. 2014. Entrepreneurs See Opportunity in Food Scraps Collection. *Biocycle* 55, no. 3:71(*http://www.biocycle.net/2014/03/28/entrepreneurs-see-opportunity-in-food-scraps-collection/*), *http://carterscompost.com/* , *http://gainesvillecompost.com/* , and *https://compostpedallers.com/* . (asessed Nov. 19, 2014)

[Figure 3 – Comparison of Bicycle-based Food Scrap Collectors]

The technology of interactive websites, bicycle fleet models and transportation software was not included in Clark's article but technology plays a crucial role in the Compost Pedallers strategy and success. The Pedallers use of smartphone applications and computer software seems to predict continued integration of smartphone based data collection into bicycle-based food scrap collection planning. Smartphone-based data collection methods can benefit planning in ways that traditional data collection methods cannot (Jackson et al., 2014) and are increasingly designed to complement bicycle use (Meyer 2013).

The web based software on Walkscore.com rates bicycle networks for specific locations on a scale from zero to one hundred based on the equally weighted factors of bike lanes on the road, elevation, road connectivity, and bike commuting mode share. The author accessed the website after shadowing a Compost Pedallers collection shift in the Cherrywood neighborhood to discover that the Cherrywood Rd. score was seventy eight, by comparison the current average bike score for Austin is forty-five [Appendix D-10]. The geography of Austin presents an increasing challenge from east to west and solving for elevation will be a curious situation for the Compost Pedallers if they choose to meet climbing membership demands located on the Balcones Escarpment.

This analysis of the Compost Pedallers approach to business and transportation of a decentralized small-scale composting program offers an example of a successful and growing for-profit food scrap collection business. Nonetheless, issues that were not discussed include the nominal problem of malodor (Hayes, 2014) and the very serious conflicts of limited space for local compost processing sites in the face of increasing food

scrap supply, and competition with larger centralized organic waste collection. There is substantial evidence suggesting that the current trend of small-scale decentralized composting programs will continue to grow until the economic barriers of scale give way to centralized larger scale compost operations (Cotton, 2014). Even with levels of integration between small and large decentralized and centralized operations, competition between these programs can be expected.

Conclusion

Compost Education

As the fastest growing area in the United States, understanding the motivations for land ownership in Central Texas might help education efforts promote participation in conservation-oriented practices (Sorice et al, 2014). A review of all Master Composter courses and creation of a collaborative statewide network of MC programs might provide a database and resource for communities that lack instructors and coordinators, and for communities to showcase and compare their programs. Further analysis and discussion of the recent San Marcos MC course should consider methods to enhance the amount of quality experiential compost training and collaboration of local compost producers, users and efforts. The required STAR MC curriculum was considered helpful by survey respondents but the book *Teaming with Microbes: a gardener's guide to the soil food web* by Jeff Lowenfels and Wayne Lewis should be considered a worthy supplement to the existing curriculum. Compost guides and training should incorporate the togetherness of adaptable relationships between humans and the microbial world to encourage quality understanding of the compost process (Abrahamsson and Bertoni, 2014: 145).

Participation and quality compost education are significant factors in efficient organic food scraps diversion (Bellwood-Howard, 2014; EPA, 2014; Platt, Goldstein, and Coker, 2014; World Bank, 2013) and trained community leaders are in demand to support local community composting efforts (Platt, Goldstein, and Coker, 2014). Analyses and reviews of composting programs in Texas are rare and not well documented, and recent attractive nationwide surveys of composting programs (ILSR, 2013) do not often include Texas cities. Coordinated statewide efforts, perhaps administered by STAR, might consider implementing more local interactive compost workshops discussions between compost end users and compost producers (Walker, Williams, and Waliczek, 2006) in addition to supporting regional workshops like Compost Camp and national community compost initiatives.

Bicycle-based Waste Diversion

Bicycle transportation is not only applicable to food scrap collection, by to a myriad of small-scale cargo and freight transportation as well. By taking advantage of technology such as the iphone application, Fix This Tool, bicyclists have the ability to document transportation issues along routes and provide crucial network data to local providers, planners and managers (Schlossberg et al., 2012). This data platform can be useful for bicycle-based food scrap collectors to identify, document and quantify hazards and issues on their routes. Parallel to the development of location-aware social media, smart phone applications like the Fix This Tool™ also have the potential to extend planning participation to individuals and bicycle-based companies who can digitally tag planning issues like traffic congestion, the need for bike paths and other transportation-related issues (Evans-Cowley, Griffin, 2012). Moreover, research and analysis of route

efficiency can be furthered by using tools such as GIS-based platforms and the Bicycle Compatibility Index (BCI) (Rybarczyk and Wu, 2010; Harkey, Reinfurt, and Knuiman, 1998).

Blending compost efforts

Texas State University's grant-funded and student-run Bobcat Blend collects food scraps and processes quality compost, yet education and research are its core existence. The efforts of Austin's Zero Waste plan invite the implementation of Master Composter courses while the Compost Pedallers command a growing market for potential master composters. Quantitative data and scientific understanding of the composting process has increased significantly in the past decade but there remains a void of research in the organics recycling industry that needs to be filled in order to reach its full potential (Alexander 2009). Being in close proximity to a multitude of educational institutes in Central Texas, there is substantial potential for blending elementary to doctoral level research components into food scrap collection, compost processing, and community compost education programs.

Integrative, collaborative, and collective community composting efforts should not rely on a single support for quality sustenance. This concept is more than sustainable; it is regenerative (Tritsch, 2013). Regenerative urban agricultural activity can ultimately help dismantle forms of racial, gender and economic oppression through education and participation but requires dialogue, reflection, evaluation and modification (Cohen and Reynolds, 2014).

Hybridization of composting efforts allow for local considerations of geography, urban structure, behavior and community that modern centralized large scale service

providers may not recognize (Griffin, Sobal, and Lyson, 2009). Perhaps there is not a single format or model of compost program that can be replicated in every community, rather, composting efforts should identify local quality components that can be adapted to fit each community appropriately. Integrated community solutions might produce certificates in Compost Science or Community Compost Studies in collaboration with preexisting organizations. The concept of producing specialized leaders for local resource management is not new, nor is it limited to developed areas with access to smartphones and software. The importance of integrating and learning from established composting efforts in developing countries through conduits such as the Peace Corps and social media cannot be over-stated (Goldstein 2001; Neave, 2011; Shakya, 2014; Zurbrügg et. al., 2005). Waste is a global issue that composting can help solve through collaborative local education and efficient food scrap collection.

LITERATURE CITED

Abrahamsson, S. and F. Bertoni. 2014. Compost Politics: Experimenting with Togetherness in Vermicomposting. *Environmental Humanities* 4: 125-148.

Al-Araki, M. 2013. SWOT analysis revisited through PEAK-framework. *Journal of Intelligent and Fuzzy Systems* 25:3: 615-625.

Alexander, R. 2009. Valuing the U.S. composting industry. *Biocycle* 50:12: 25-27.

American Dietetic Association. 2001. Position of the American Dietetic Association: Dietetics professionals can implement practices to conserve natural resources and

protect the environment. *Journal of the American Dietetic Association* 101:10: 1221–1227.

Audi, L., P. Keating, B. Sterling, and H. Weber. 2014. Feasibility of Student-Run Composting At McElroy Dining Hall. Boston College. http://www.bc.edu/content/dam/files/schools/cas_sites/envstudies/pdf/Student%20Research/9_Student-run_Composting_at_McElroy_Dining.pdf

Belasco, W. 1993. Appetite for change: How the counterculture took on the food industry. Ithaca, NY: Cornell University Press.

Bell, J., J. Huber, and W.Viscusi. 2014. Trends in Household Recycling of Cans, Paper, Plastic, and Glass; US And State Data 2005–2012. Vanderbilt Law and Economics Research Paper 14-3.

Bonneau, L. 2003. Texas Master Naturalist program assessment: changes in volunteer knowledge and attitudes as a result of training. Diss. Stephen F. Austin State University.

Brandt, Christina. Interviewed by author. Phone interview. Austin, August 27, 2014.

Brandt, Christina. E-mail message to author, September November 11, 2014.

Brown, Sally. 2013. CO2 Math for Food Waste Transport. *Biocycle* 54:7: 60. http://www.biocycle.net/2013/08/01/connection-co2-math-for-food-waste-transport/

Cantor, J. 2002. Skills certifications and workforce development: Partnering with industry and ourselves. *Leadership Abstract*, 15: 1.

Carland, J., F. Hoy, W. Boulton, and J. Carland. 1984. Differentiating Entrepreneurs from Small Business Owners: A Conceptualization. Academy Of Management Review 9:2: 354-359.

City of Austin, Resource Recovery Department. *The Austin Resource Recovery Master Plan*, December 11, 2011. Accessed 2 November, 2014. http://www.austintexas.gov//sites/default/files/files/Trash_and_Recycling/MasterPlan_Final_12.30.pdf

Clark, Nate. 2014. Entrepreneurs see opportunity in food scraps collection. *Biocycle*. 55: 3:71.

Cohen, N., and K. Reynolds. 2014. Resource needs for a socially just and sustainable urban agriculture system: Lessons from New York City. Cambridge University Press. *Renewable Agriculture and Food Systems.* Accessed 10 November, 2014. http://journals.cambridge.org/download.php?file=%2FRAF%2FS1742170514000210a.pdfandcode=59d6e63b06d15ee70244640216120c97

Coker, Craig. 2009. Source Separated Organics Collection. *Biocycle* 50:1:23.

Cotton, Matt. 2014. Compostable Collections in a Low Tip Fee Market. Lecture at Texas Disposal Systems, S.T.A.R. and Texas Compost Council, Compost Camp. Buda, TX, 22 September, 2014.

Cornell Waste Management Institute. 1998. Master Composter Manual. Cornell University Press. Ithaca, NY. http://cwmi.css.cornell.edu/mastercompostermanual.pdf

Davidson, Jane. 2011. “Breaking out of the Likert scale trap”. *Genuine Evaluation Blog.* February 7. Accessed 13 November, 2014. http://genuineevaluation.com/breaking-out-of-the-likert-scale-trap/

Downing, A., J. Kays, and J. Finley. 2009. Backyard Woodlots: Large Scale Education for Small Acreages. Seeing the Forest Beyond the Trees. IUFRO 3.08 Small Scale Forestry Symposium.

Ebreo, A., and J. Vining. 2000. Motives as predictors of the public's attitudes toward solid waste issues. *Environmental management*, 25:2: 153-168.

Evans-Cowley, J., and G. Griffin. Microparticipation with Social Media for Community Engagement in Transportation Planning. 2012. Transportation Research Record: *Journal of the Transportation Research Board*, 2307: 90–98.

Fekpe, E. 2002. Impacts of Rural Road Improvements on Operating Costs of Bicycles and Motorcycles. *Transportation Quarterly* 56:2: 89-107.

Folz, D.and J. Hazlett. 1991. Public participation and recycling performance: explaining program success. *Public Administration Review*: 526-532.

Folz, D. 1999. "Municipal Recycling Performance: A Public Sector Environmental Success Story." *Public Administration Review* 59, no. 4: 336-345.

Liss, G. 2008. Austin Texas Zero Waste Strategic Plan. City of Austin. Gary Liss and Associates.

Glenn, J., and N. Goldstein. 1999. Food residuals composting in the US. *Biocycle*. 40:8: 30-36.

Griffin, M., J. Sobal, and T. Lyson. 2009. An analysis of a community food waste stream. *Agriculture and Human Values* 26:1-2: 67-81.

Goldstein, N. 2001a. The composting industry in the United States: past, present, and future. Compost Utilization in Horticultural Cropping Systems: 3-16.

Goldstein, N. 2001b. Compost: a universal language. *Biocycle* 42:11: 4.

Gruber, J., A. Kihm, and B. Lenz. 2014. A new vehicle for urban freight? An ex-ante evaluation of electric cargo bikes in courier services. *Research In Transportation Business and Management* 11: 53.

Hamm, M., and A.C. Bellows. 2003. Community food security and nutrition educators. *Journal of Nutrition Education and Behavior* 35:1: 37–43.

Handy, S., B.Wee, and M. Kroesen. 2014. Promoting Cycling for Transport: Research Needs and Challenges. *Transport Reviews* 34:1:4-24.

Harkey, D., D. Reinfurt, and M. Knuiman. 1998. Development of the bicycle compatibility index. *Bicycle And Pedestrian Research*. 1636:13-20.

Harrison, G., W. Rathje, and W. Hughes. 1975. Waste behavior in an urban population. *Journal of Nutrition Education.* 7:1:13–16.

Hayes, J., R. Stevenson, and R. Stuetz. 2014. The impact of malodour on communities: A review of assessment techniques. *Science of the Total Environment* 500: 395-407.

Hyodo, T., N. Suzuki, and K. Takahashi. 2000. Modeling of bicycle route and destination choice behavior for bicycle road network plan. *Transportation Research Record: Journal of the Transportation Research Board* 1705:1: 70-76.

Institute for Local Self-Reliance (ILSR). 2013. ILSR October 2013 Survey Results: Community-Based Composters. ILSR.org. Accessed 14 November, 2014. http://www.ilsr.org/wp-content/uploads/2014/07/community-composting-survey-results-2013.pdf

Jackson, S., L. Miranda-Moreno, C. Rothfels, and Y. Roy. 2014. Adaptation and Implementation of a System for Collecting and Analyzing Cyclist Route Data Using Smartphones. *Transportation Research Board 93rd Annual Meeting*, 14:4637.

Karnchanawong, S, and N. Suriyanon. 2011. Household organic waste composting using bins with different types of passive aeration. *Resources Conservation And Recycling* 55:5: 548-553.

Kashmanian, R. 1995. Poultry industry finds added value in composting. *Biocycle* 36: 55-57.

Kashmanian, R. and R. Rynk. 1996. Agricultural composting in the united states: Trends and driving forces. *Journal of Soil and Water Conservation* 51:3:194 http://search.proquest.com/docview/220961814?accountid=5683

Krenn, P., P. Oja, and S. Titze. 2014. Route choices of transport bicyclists: a comparison of actually used and shortest routes. *International Journal Of Behavioral Nutrition and Physical Activity* 11:1: 1-12.

Lee, J., and I. Paek. 2014. In Search of the Optimal Number of Response Categories in a Rating Scale. *Journal of Psychoeducational Assessment*: 0734282914522200.

Markle, G. 2014. Accounting for the Performance of Environmentally Significant Behavior: The Symbolic Significance of Recycling. *Symbolic Interaction*, 37:2: 246-263.

McLeod, C., M. Terazawa, E. Yamamura. 1997. Using Geographical Information Systems to Evaluate Decentralized Management of Municipal Food Waste. *Compost Science and Utilization* 5:1.

Meewes, V. 2014. A Healthy Cycle for Austin's Compost Scene. Good Magazine. Accessed 11 November, 2014. http://magazine.good.is/articles/east-side-compost-pedallers

Meier, E., T. Waliczek, and M. Abbott. 2014. Composting Invasive Plants in the Rio Grande River. *Invasive Plant Science and Management* 7:3: 473.

Metrofiets, LLC. 2014. About. Metrofiets.com. Accessed 11 November, 2014. https://metrofiets.com/location/

Meyer, J. 2013. Big Bike Data: How GPS Route Data Collected from Smartphones can Benefit Bicycle Planning. Thesis, University of Texas at Austin.

Montoya, John E., Tina M. Waliczek, and Michael L. Abbott. 2013. Large Scale Composting as a Means of Managing Water Hyacinth (Eichhornia crassipes). *Invasive Plant Science And Management* 2: 243.

Neave, S. 2011. How to conduct a compost-making workshop: A course for trainers. *AVRDC-World Vegetable Center*, Shanhua, Taiwain. AVRDC Publication 11: 748.

NYC Department of Sanitation. 2014. CPDP: Compost Project Display Poster. *New York City Department of Sanitation, Bureau of Waste Prevention, Reuse and Recycling: Compost Project.* Accessed 10 November, 2014. http://www.nyc.gov/html/nycwasteless/downloads/pdf/nyc-compost-project/NYC_Compost_Project_Poster.pdf

Petty, R. 2001. The product life cycle and the use of bicycles to deliver goods and services. *Milestones in Marketing History: Proceedings of the 10th Conference in Historical Analysis and Research in Marketing*, 117-127.

Platt, B., N. Goldstein, and C. Coker. 2014. State Of Compositing in the U.S. *Biocycle* 55:6: 19

Platt, B., J. McSweeney, and J. Davis. 2014. Growing Local Fertility: A Guide to Community Composting. The Highfields Center for Composting and the Institute for Local Self-Reliance (ILSR). Accessed 3 October, 2014. http://www.ilsr.org/wp-content/uploads/2014/07/growing-local-fertility.pdf

Perron, B., and A. Stearns. 2011. A review of a presentation technology: Prezi. *Research On Social Work Practice* 21:3: 376-377.

Profita, C. 2013. In Portland: Can Freight Bikes Replace Trucks? Oregon Public Broadcasting. Accessed 2 November, 2014. http://www.opb.org/news/blog/ecotrope/in-portland-can-freight-bikes-replace-trucks/

Rahm, J. 2014. Reframing research on informal teaching and learning in science: Comments and commentary at the heart of a new vision for the field. *Journal of Research in Science Teaching* 51:3: 395-406.

Rai, R. 2011. Community Participation in Solid Waste Management in Kathmandu Metropolitan City, Nepal. *Proceedings of the International Conference on Waste Technology and Management* 1123-1130.

Rockinson-Szapkiw, A., A. Knight, and J. Tucker. 2011. Prezi: Trading linear presentations for conceptual learning experiences in counselor education. Counsel for Higher Education Pedagogy. Blacksburg, VA.

Rybarczyk, G, and CS Wu. 2010. Bicycle facility planning using GIS and multi-criteria decision analysis. *Applied Geography* 30:2: 282-293.

Sembera, J. 2013. Composting as an Alternative Management System for Wild Taro (Colocasia esculenta) and Brown Algae (Sargassum fluitans and Sargassum natans). M.S. Thesis. Texas State University, San Marcos, TX.

https://digital.library.txstate.edu/handle/10877/4867

Shakya, M., I. Bellwood-Howard, H. Karg, and J. Schlesinger. 2014. Bridging the gap between increasing knowledge and decreasing resources. Tropentag International Conference on Research on Food Security, Natural Resource Management and Rural Development. Prague, Czech Republic. Accessed 10 November, 2014. http://www.tropentag.de/2014/abstracts/links/Shakya_tpa6IMsL.pdf

Schlossberg, M., C. Evers, K. Kato, and C. Brehm. 2012 Active Transportation, Citizen Engagement and Livability: Coupling Citizens and Smartphones to Make the Change. URISA Journal, 24:2: 65–74.

Sorice, M., U. Kreuter, B. Wilcox, and W. Fox III. 2014. Changing landowners, changing ecosystem? Land-ownership motivations as drivers of land management practices. *Journal of Environmental Management*, 133:144-152.

State of Texas Alliance for Recycling (STAR). 2014. About S.T.A.R. Recyclingstar.org. Accessed 10 September, 2014. http://www.recyclingstar.org/about-star/

Thomas, C. 2001. Public understanding and its effect on recycling performance in Hampshire and Milton Keynes. *Resources Conservation and Recycling*. 32: 259–274.

Tripathi, N. 2013. Where the Road is Without Congestion and Environment is Pollution Free: Trip to Sustainable Urban Mobility. *OIDA International Journal of Sustainable Development*. 6:8: 27-34.

Tritsch, Katherine. 2013. Moving Beyond Sustainability at Institutes of Higher Education: The Potential of a Permaculture Initiative at Texas State University-San Marcos. https://digital.library.txstate.edu/handle/10877/4474

U.S. Census Bureau. 2014. State and County Quickfacts: Austin(City), Texas. Accessed 28 October, 2014. http://quickfacts.census.gov/qfd/states/48/4805000.html

U.S. Composting Council. 1996. Field Guide to Compost Use. U.S. Composting Council, Amherst, Ohio.

U.S. Composting Council. 2008. USCC Fact Sheet: Compost and Its Benefits. U.S. Compost Council Facts and Free Reports. Compostingcouncil.org. Accessed 30 September, 2014. http://compostingcouncil.org/wp/wp-content/uploads/2010/09/Compost-and-Its-Benefits.pdf

U.S. Environmental Protection Agency (EPA). 2014. Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012. Washington, DC. EPA-530-F-14-001. Accessed 13 October, 2014. http://www.epa.gov/solidwaste/nonhaz/municipal/pubs/2012_msw_fs.pdf

Van Vliet, L. 2014. Stabilizing a cargo bike. PhD diss., TU Delft, Delft University of Technology.

Vining, J. and A. Ebreo, 1989. An Evaluation of the Public Response to a Community Recycling Education Program. *Society and Natural Resources*, 2: 23-36.

Vining, J. and A. Ebreo. 1990. What Makes a Recycler? A Comparison of Recyclers and Nonrecyclers. *Environment and Behavior*, 22: 55-73.

Walker, P., D. Williams, and T. Waliczek. 2006. An analysis of the horticulture industry as a potential value-added market for compost. *Compost science and utilization* 14:1: 23-31.

Waste Concern. 2010. Decentralized Compost. Wasteconcern.org. Accessed 28 September, 2014. http://www.wasteconcern.org/Publication/Decentralized%20Composting.pdf

Weissblueth, E., Y. Nissim, and S. Amar. 2014. Educating for the Future: A Structured Course to Train Teachers for the 21st Century. Creative Education 2014.

World Bank. 2012. What a Waste: A Global Review of Solid Waste Management. Urban Development. Accessed 13 October, 2014. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTURBANDEVELOPMENT/0,,contentMDK:23172887~pagePK:210058~piPK:210062~theSitePK:337178,00.html

World Bank. 2014a. Urban Solid Waste Management. Accessed 20 October, 2014. http://go.worldbank.org/A5TFX56L50

World Bank. 2014b. Low-emission Transport. Brief. Accessed 26 November, 2014. http://www.worldbank.org/en/topic/transport/brief/low-emission-transport

Zurbrügg, C., S. Drescher, I. Rytz, A. Sinha, and I. Enayetullah. 2005. Decentralized composting in Bangladesh, a win-win situation for all stakeholders. *Resources, Conservation and Recycling* 43:3: 281-292.

Appendix A – Public Service Announcement: City of San Marcos Fall 2014 Master Composter

City of San Marcos
630 E. Hopkins
San Marcos, Texas 78666

NEWS

September 15, 2014

Contact: Trey Hatt, Communications Specialist, 512.393.8242 ghatt@sanmarcostx.gov
Amy Kirwin, Solid Waste Coordinator, 512.393.8407 akirwin@sanmarcostx.gov

Master Compost Certification Course

City Offers New Program to Teach Composting

The City of San Marcos is offering a new program for residents to become better aware of the benefits composting has for our environment and invites the community to take part.

COMPOST: The City of San Marcos is offering a Master Compost Certification course in October.

The City of San Marcos and Bobcat Blend, a student-run composting organization at Texas State University, are teaming up for the first Master Composter Certification Program to educate residents and promote composting. The program is administered by the State of Texas Alliance for Recycling (STAR).

Residents interested in signing up for the Master Composter Certification course should contact Amy Kirwin at akirwin@sanmarcostx.gov by Oct. 10. Space is limited to 20 students.

Program requirements include $20 for textbooks, 20 hours of total classroom time and 20 hours of volunteering within six months of classroom work completion.

Classroom Dates and Times:
October 13, 15, 20, 22 from 6-8:30 p.m.
October 18, 25 from 9 a.m.-2 p.m.

Location:
San Marcos Nature Center
430 Riverside Dr.

Appendix B - Images

Image 1 – San Marcos Nature Center. Credit: author

Image 2 – Bobcat Blend's 1,600 gallon compost tea brewer. Credit: author

Image 3 – Prezi.com "Organic" layout. Credit: author

Image 4 – Field day; unloading food scraps. Credit: author

Image 5 – Field day; screening compost. Credit: author

Image 6 – Field day; testing piles. Credit author

Image 7 – Field day; class photo. Credit author

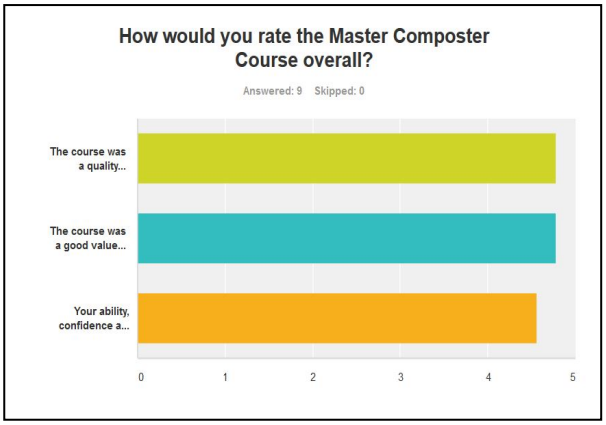
Image 8 – Field day; pest identification. Credit author

Image 9 – Field day; Dunbar Garden. Credit author

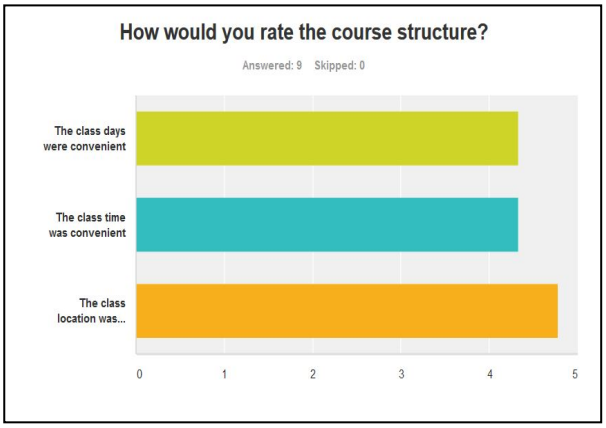
Image 10 – Field day; bin assembly. Credit author

Appendix C – Survey Results

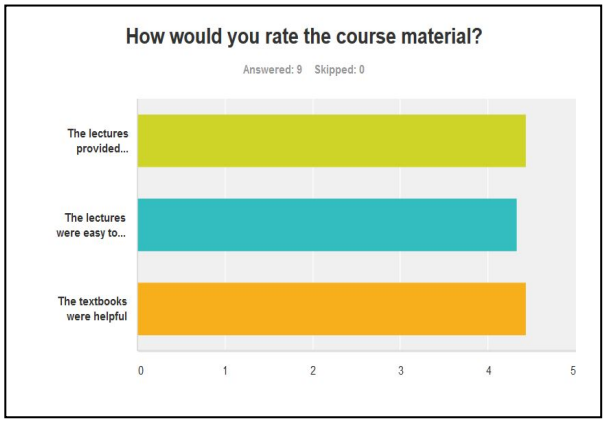
1 –



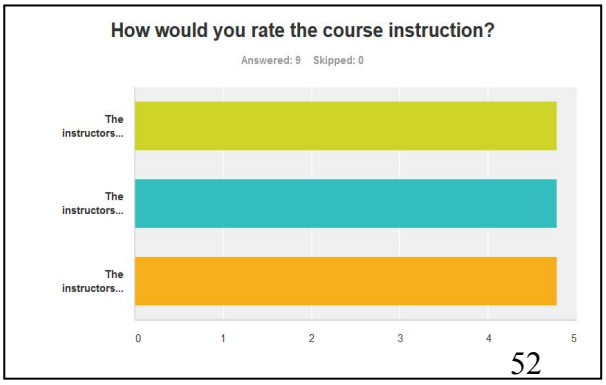
2 –



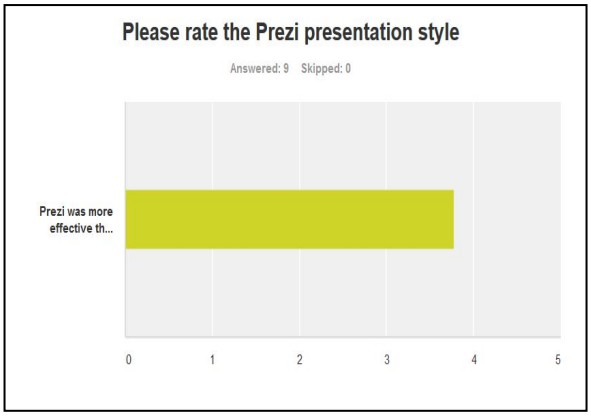
3 –



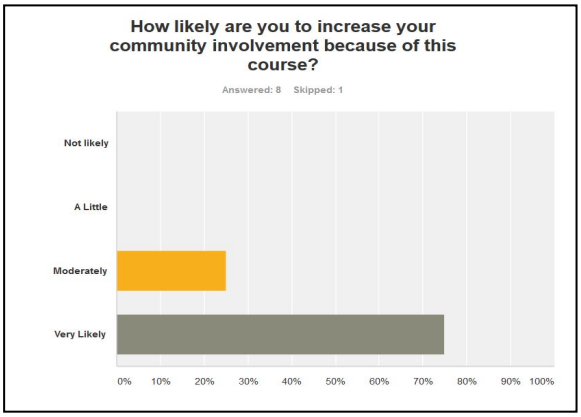
4 –



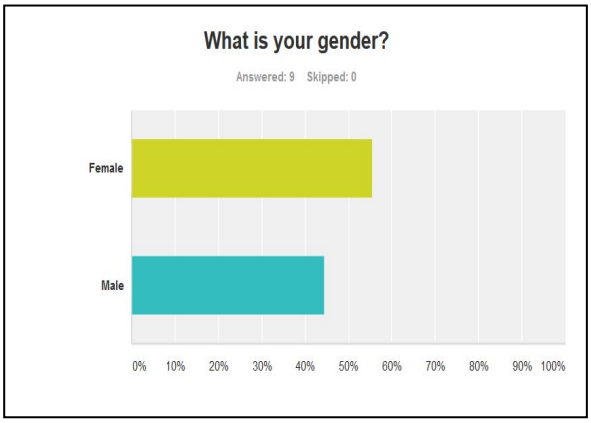
5 –



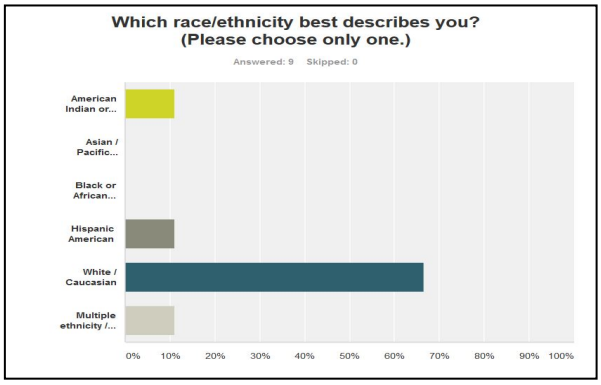
6 –



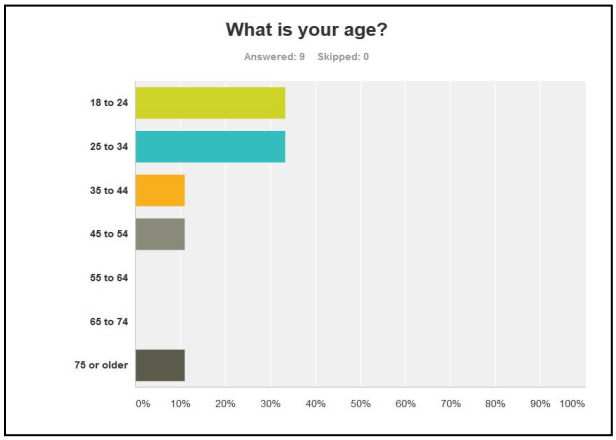
7 –



8 –



9 –



10 –

Again, more hands-on material would have really completed the course. It's hard to say how that could get worked into the course though, as there was no time wasted. Longer course maybe. Had a great time and will recommend to others. 11/6/2014 7:45 AM View respondent's answers
One hour sessions. 11/5/2014 7:02 PM View respondent's answers
The only suggestion I have is to add something that involves the students personal compost. Maybe they bring in photos or a sample and the class can go over what they do right and where they can improve. 11/3/2014 9:50 AM View respondent's answers
Doing more actual hands on composting - including test piles/heaps of different materials and/or processes. Hosting the video projects suggested at the beginning of the course. 10/28/2014 9:50 PM View respondent's answers
More hands on activities during the lectures would have been great and would aid in keeping students engaged, but overall the course was very rewarding, helpful and really taught me a lot. 10/28/2014 6:50 PM View respondent's answers

11 –

I feel like there could have been more hands-on material. But all-in-all, GREAT CLASS!! 11/6/2014 7:45 AM View respondent's answers
I had limited knowledge about managing a compost ben. The course and books purchased have definitely increased my knowledge. 11/5/2014 7:02 PM View respondent's answers
My desire to compost was significantly enhanced! I wish the course went into the science of compost, although the course materials (i.e. books) provided ample opportunity for going more in depth of specific topics individuals found more interesting or wanted more information. 10/28/2014 9:50 PM View respondent's answers
Would like to see more hands on experiences for future classes. 10/28/2014 11:00 AM View respondent's answers

12 –

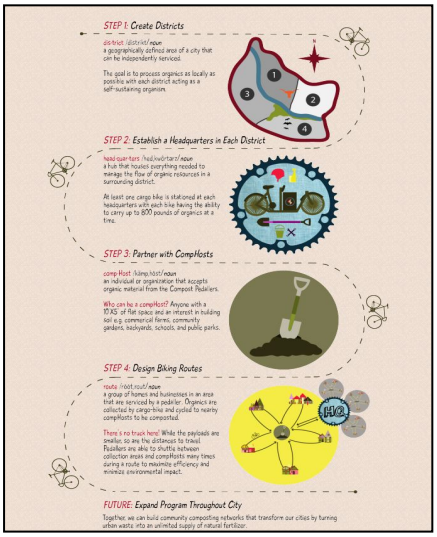
Cover compost pile basic for people who never composted before so they can have a framework. I already knew how to compost so I was able to understand material. 10/28/2014 11:00 AM View respondent's answers
Consider a short field trip at the beginning of the course to a well done backyard compost system. E.g. At the nature center or community garden. It would set the scene for the detailed info presented in the lecture. I'd also suggest that the instructors identify 4-5 learning objectives that guide their lectures. They are often written as "at the end of this lesson, the student will be able to explain the difference between x and y. Action verbs (list, describe, calculate etc) are used for learning objectives. It helps the instructor focus lecture material and assess whether s/he was successful in transferring the info to the students. Thanks for an enjoyable and informative class 10/27/2014 12:11 PM View respondent's answers

Appendix D – Compost Pedallers Images

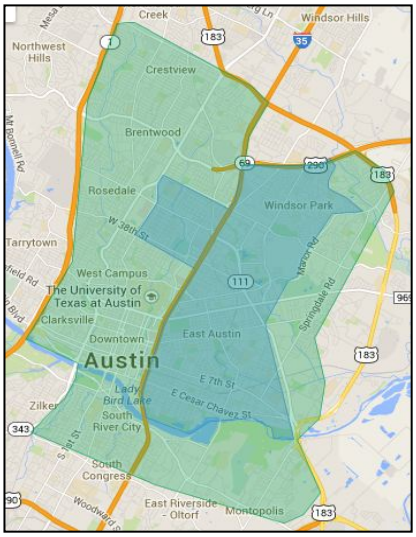
1 – Metrofiets. Credit: Goodnewsnetwork.org

2 – Credit: Compostpedallers.com

3 – Credit: Compostpedallers.com



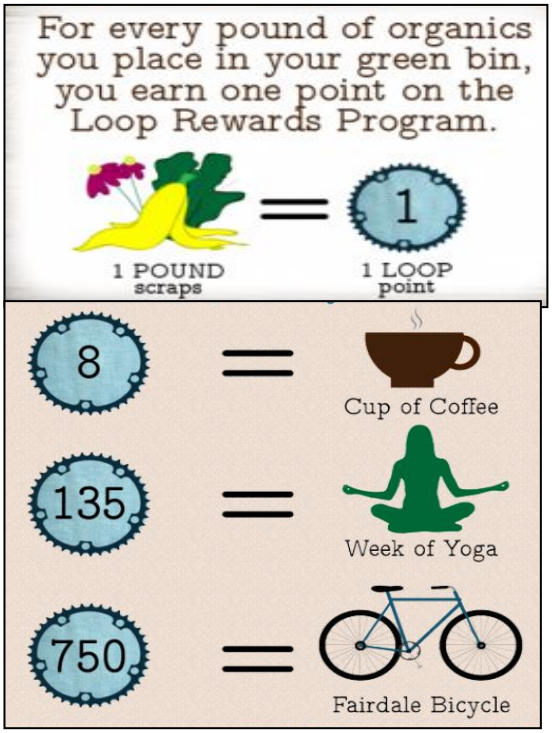
4 – Credit: Compostpedallers.com



5 – Credit: Compostpedallers.com

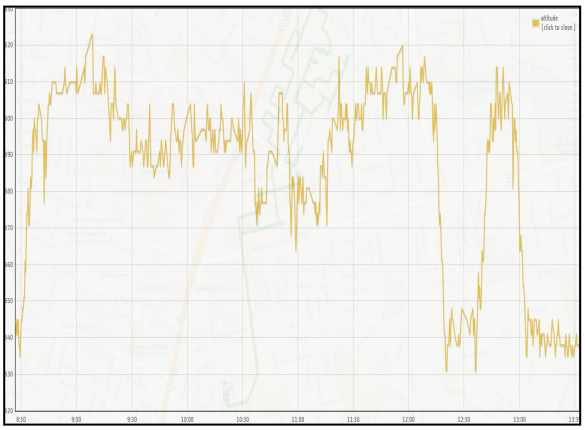
6 – Credit: Compostpedallers.com

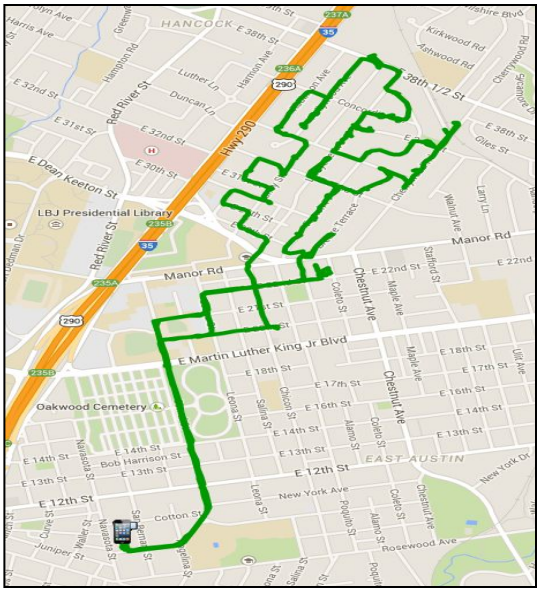
7 – Credit: Compostpedallers.com



8 – Credit: Meewes, 2014.

9 – Route Elevation. Credit: Tyler Markham; Compost Pedallers.





10 – Austin Bikescore. Credit: Walkscore.com